

$h \rightarrow \gamma\gamma$ Status/Plans

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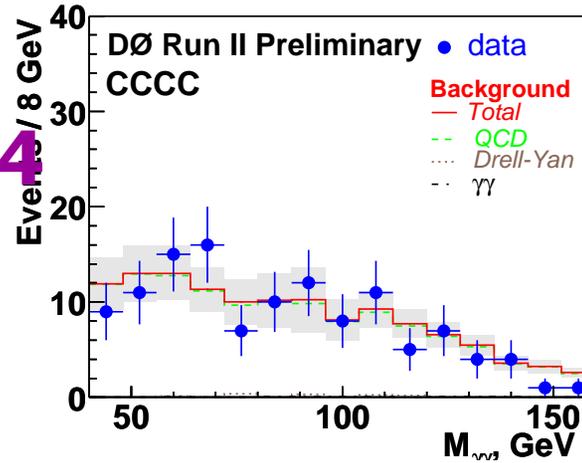


Summary of 08/19/04 $h \rightarrow \gamma\gamma$ update

1. We have robust Neural Nets trained on data that provides background rejection factor of 1.5-2 wrt current EMID at the same efficiency
 - *Input variables = (almost) those of HMatrix7, could still try find optimal set*
 - *Restrict NN studies/analysis to CCCC*
 - *Discrepancy in CC fake rate between CCCC and CCEC remains (ununderstood)*
 - *Fake rate increase after diphoton $PT > 35$ GeV cut is applied remains (ununderstood)*
2. Tried to use it in the analysis – get data/bkgd discrepancy in the mass spectrum.

CCCC $\gamma\gamma$ mass (from 08/19/04 update)

HM7+trkiso →



data = 121.0

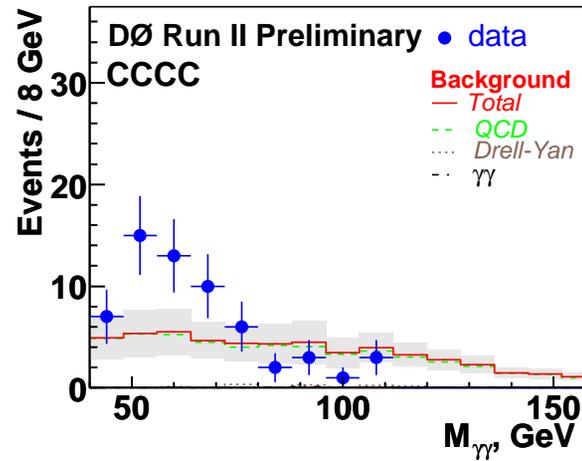
bkgd = 126.3 +- 28.1

QCD = 123.5 +- 28.1

DY = 2.0 +- 1.9

$\gamma\gamma$ = 0.8 +- 0.2

NN1 →



data = 60.0

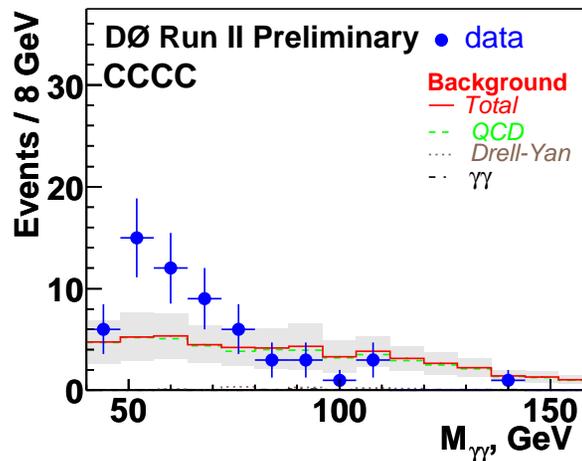
bkgd = 53.3 +- 21.2

QCD = 50.6 +- 21.2

DY = 2.0 +- 1.9

$\gamma\gamma$ = 0.8 +- 0.2

NN2 →



data = 59.0

bkgd = 51.7 +- 22.0

QCD = 48.9 +- 21.9

DY = 2.0 +- 1.9

$\gamma\gamma$ = 0.8 +- 0.2

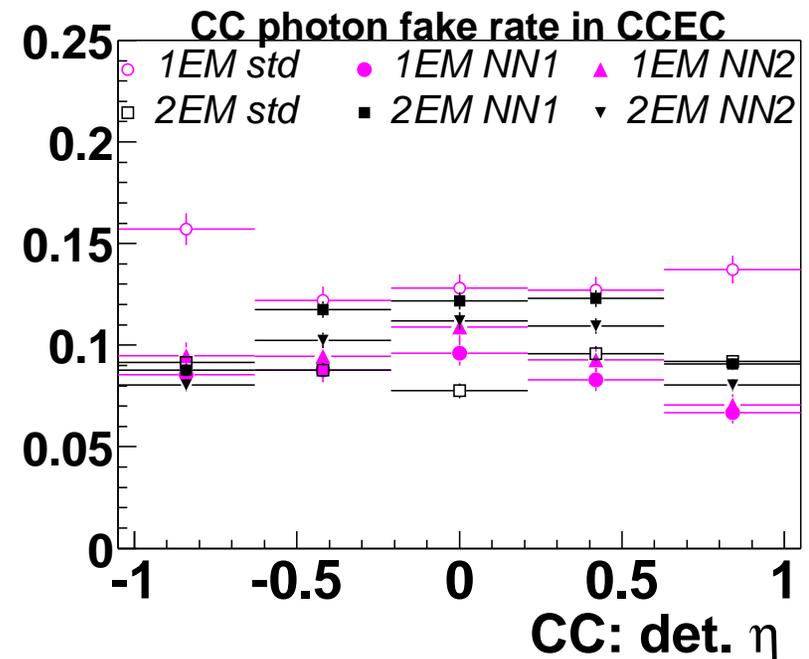
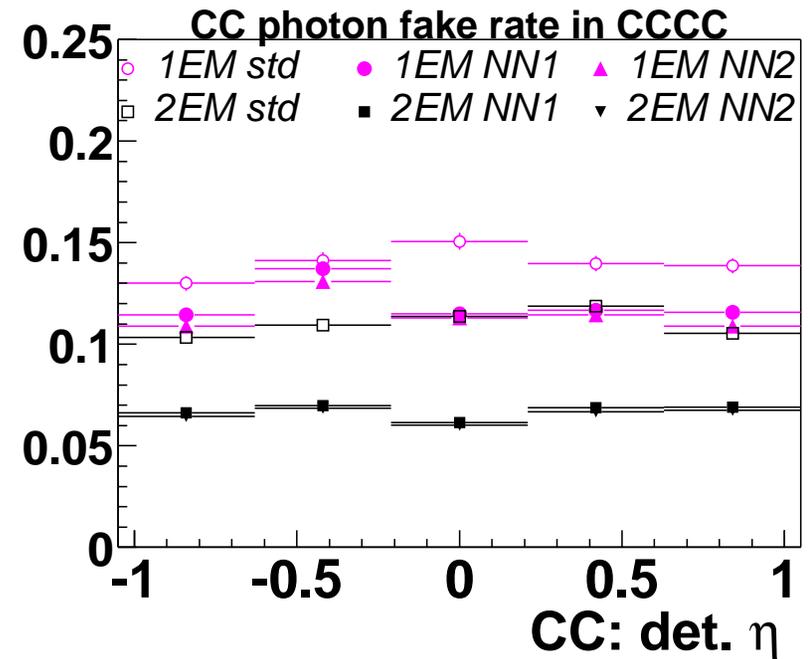
Photon Fake Rates

- calculate photon fake rate with established NN output cuts and compare with “HM+trkiso” rates

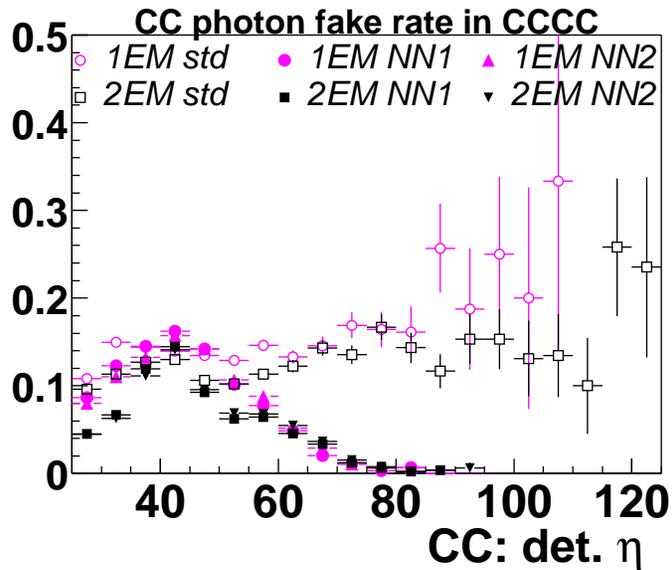
- look at both Single(exactly one) EM and diEM(Z-mass region vetoed) samples

- compare performance of 2 NNs

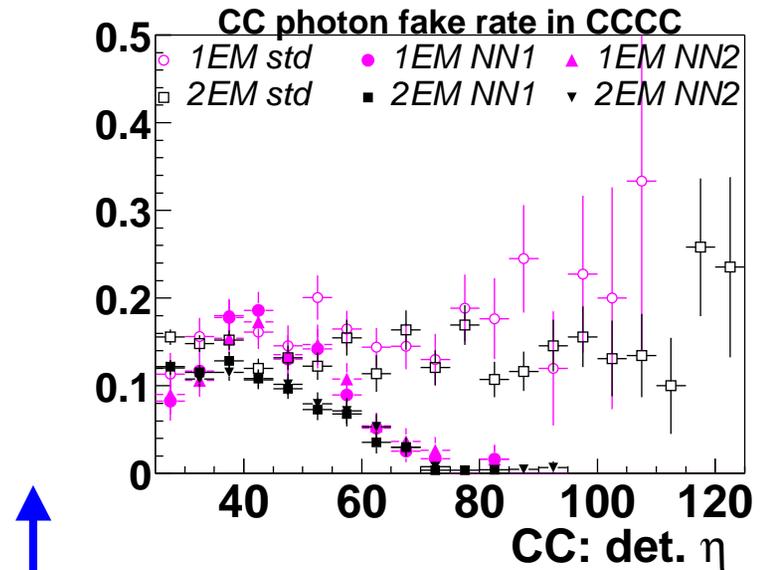
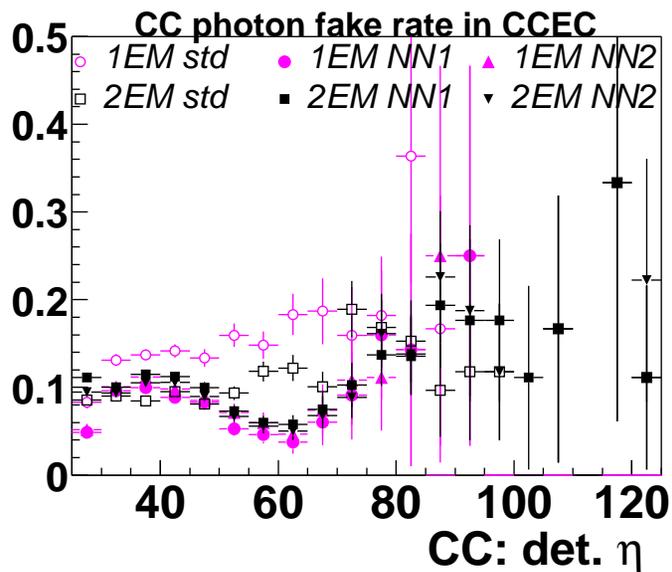
bkg rejection factor of ~ 1.5



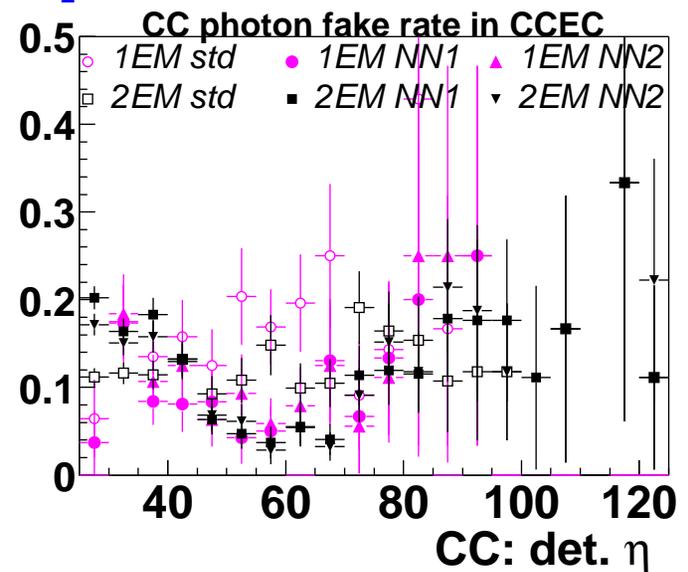
Try PT-dependent Fake Rates



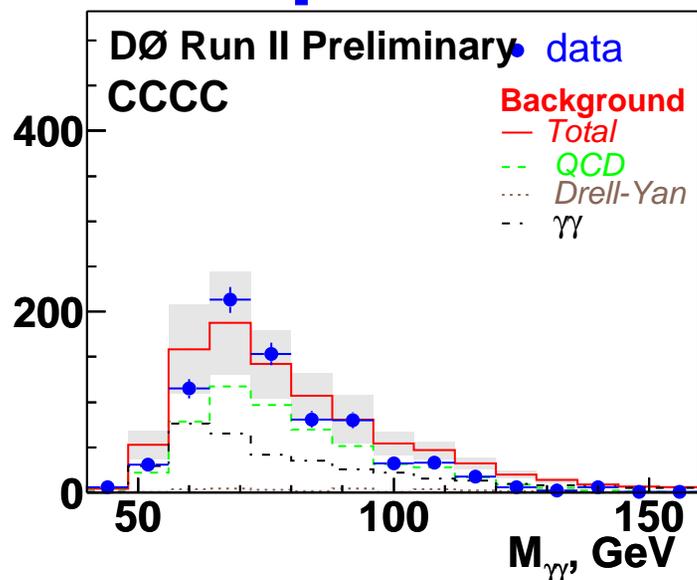
No diphoton cut



diphoton $PT > 35$ GeV



No diphoton cut



data = 778.0

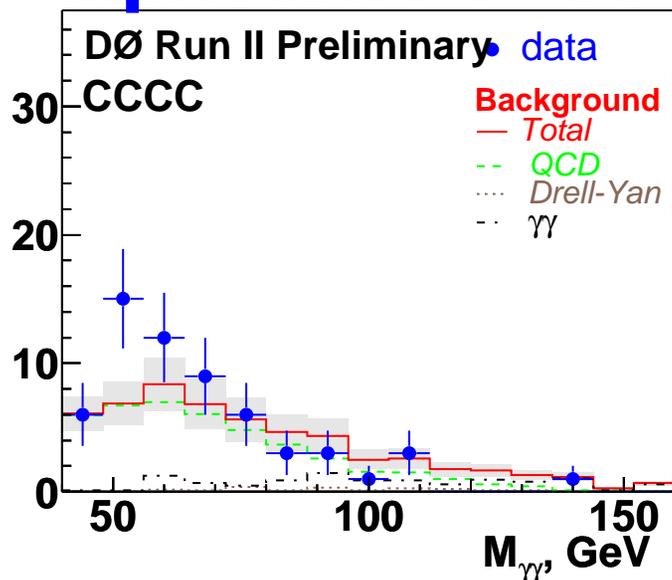
bkgd = 922.9 \pm 242.6

QCD = 535.5 \pm 215.1

DY = 28.3 \pm 27.9

$\gamma\gamma$ = 359.1 \pm 108.8

diphoton $PT > 35$ GeV



data = 59.0

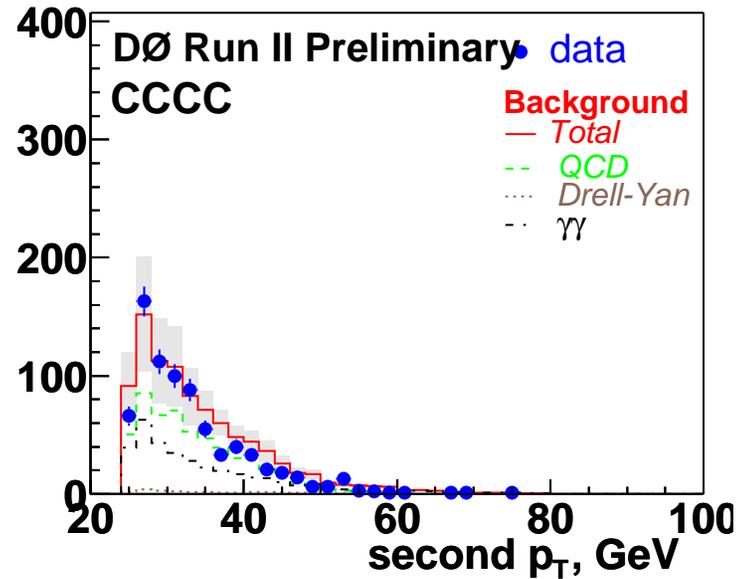
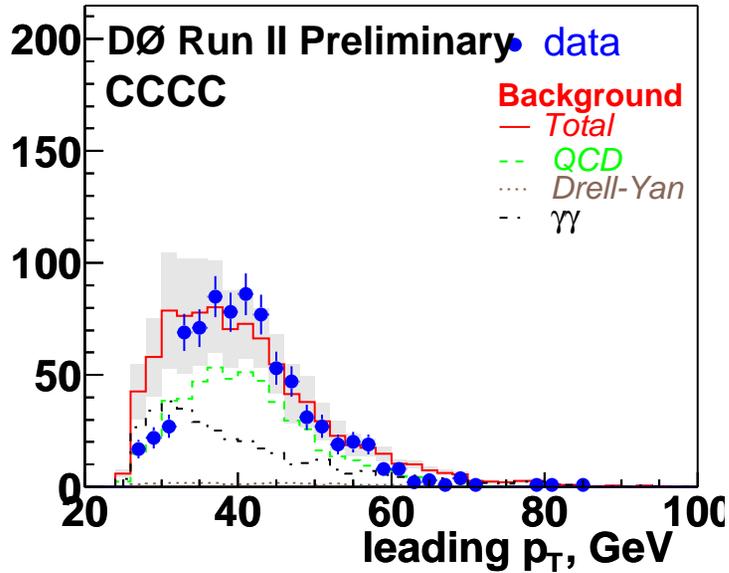
bkgd = 54.5 \pm 14.3

QCD = 42.0 \pm 13.8

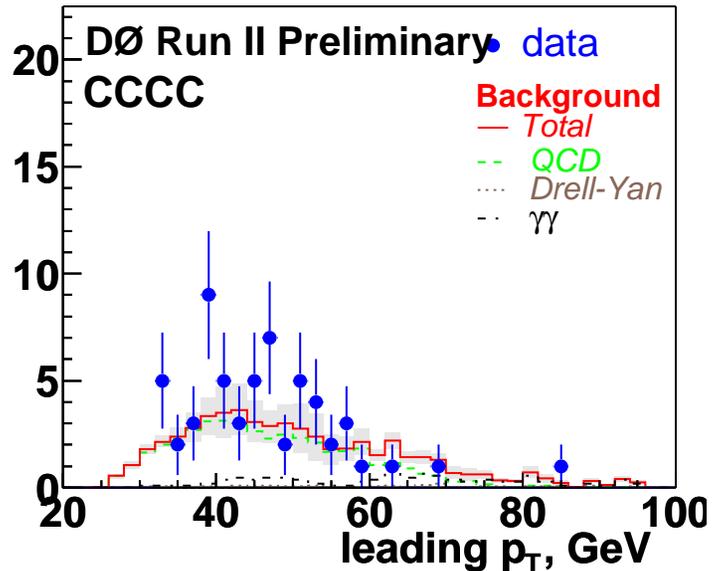
DY = 2.0 \pm 1.9

$\gamma\gamma$ = 10.6 \pm 3.2

No diphoton cut : Photon p_T distributions



diphoton $p_T > 35$ GeV: leading Photon p_T



Summary (so far)

1. Fake rates with Neural Net
(unlike with current EMID)
have strong PT-dependence
2. PT-dependent fake rate allows to describe the
backgrounds reasonably well
3. Can proceed with the analysis !

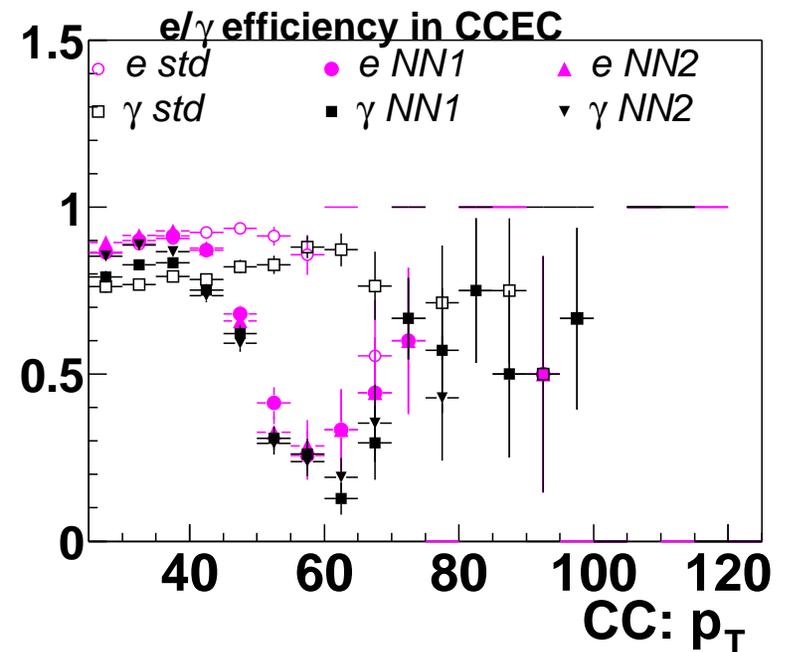
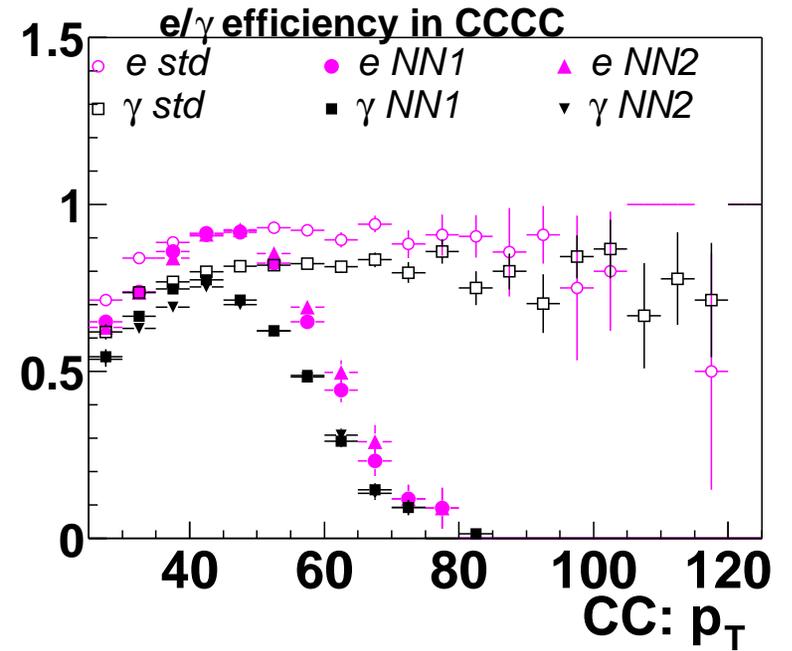
BUT

What about PT-dependence of signal efficiency ?

**NN signal
efficiency drops for
 $p_T \geq 40-50$ GeV**

**Won't work for
 $h \rightarrow \gamma\gamma$ search**

Is this related to p_T -spectrum of training samples (Z- \rightarrow ee data) ?
HMx7 (single electron) training sample is flat in p_T up to above 100 GeV



Try retraining NN with HM7 single electron training sample

- Got the d0sim MC sample (from Michel Jaffre) onto clued0 disk : 70k single electrons
- Encountered 2 technical problems:
 1. d0correct/tmb_analyze v6/v6a doesn't work with MC anymore (smth seems to have changed in the environment) – tried this with Z->ee and gammagamma MC (Fu tried to reinstall d0correct – didn't help)
 2. D0reco doesn't run on the single electron MC files – smth related to FPS (Abid took a look – waiting for response from Andre)

Status Summary/Plans

1. It seems that NN trained on data signal won't work for this analysis (due $Z \rightarrow ee$ electrons having lower PT than $h \rightarrow \text{gammagamma}$ photons we look for)
2. Try retraining NN with MC electrons covering high PT range and compare background rejection performance. Currently technical problems
3. Other solutions, e.g. finding NN input variable set insensitive to PT-dependence ? Ideas are welcome.